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WATERTOWN ARSENAL LABORATORY

MEMORANDUM REPORT

NO. WAL 710/230

Comparison of Resistance Characteristics of

Flyers' Protective Armor, M1, and Experimental Armor Vest, T39

and the Effect of Component Plate Size

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BY

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WATERTOWN, MASS.

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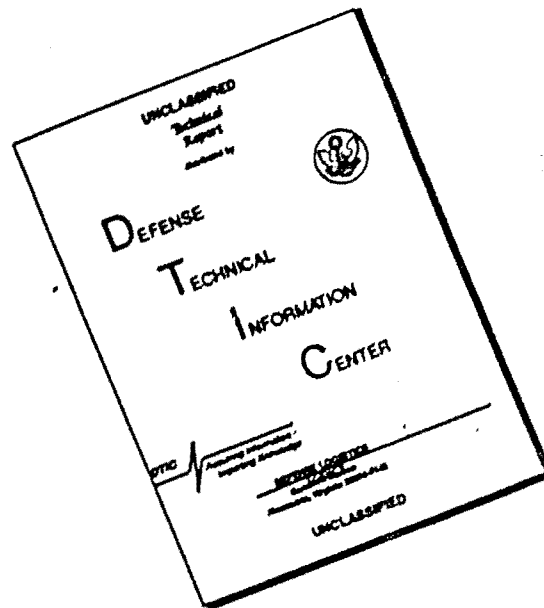
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First Partial Report on Problem B-8.3

12 October 1944

Comparison of Resistance Characteristics of
Flyers' Protective Armor, M1, and Experimental Armor Vest, T39
and the Effect of Component Plate Size

1. At the request of the Office, Chief of Ordnance^{1,2}, tests ~~have~~ ^{were} recently been conducted on samples of Flyers' Protective Armor, M1 (back) and on samples of Experimental Armor Vest, T39.

2. The resistance of the Experimental Armor Vest, T39, to perforation by cal. .45 steel-jacketed ball projectiles or by cal. .30 flak-simulating projectiles G-1-S (34 grains) or G-1-A (150 grains)³ is superior to that of the M1 Vest. This superiority is believed to be attributable to the larger plate size as well as the unique assembly of the T39 vest. Since both vests resisted perforation by the cal. .22 fragment-simulator, G-2⁴, at velocities obtainable with the present test equipment the comparative resistance of these vests under impact of such a projectile was not evaluable.

3. Three samples of both types of armor were received and examined for construction and component characteristics. Whereas the weight-per-unit-area-of-protection and the thickness of the Hadfield manganese steel components are essentially the same in both types, the size of the components and the method of assembly differs. In the M1 type 2" x 2" squares of Hadfield manganese steel are assembled in vertical latticed strips which overlap each other horizontally so that impact of the projectile is variously opposed by one, two or three thicknesses of steel. In the T39 type 3" x 3" plates of Hadfield steel are assembled contiguously in horizontal strips which overlap vertically in the manner of shingling so that the junction of the contiguous plates of one strip coincides with the middle of a plate

1. O.O. 422/793 - Wtn. 470.5/31.
2. O.O. 400.112/9215(r) - Wtn. 400.112/3161(r).
3. WAL 762/247(c).
4. WAL 762/253(c).



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on the next lower strip. Thus, except around the edges of the assembly, projectile impact will be opposed by a double thickness of steel. (See Photographs WTN 710/2329 and WTN 710/2330 attached.)

4. The samples were strapped firmly to a sawdust filled canvas dummy and ballistic limits determined with cal. .45 steel-jacketed ball projectiles and with the three types of fragment-simulators in use at this arsenal. The results appear in Table I.

5. Perusal of this table will disclose a consistent superiority of the T39 armor in resistance to perforation by the several projectiles employed. Since the thickness of the component plates and the overall weight-per-unit-area-of-protection are roughly the same for both types, it is reasonable to attribute this superiority to the larger plate size and the different assembly of the T39 vest.

6. It has been previously noted⁵ that perforation of the M1 jacket has frequently been effected by turning aside the components rather than perforating them. The larger components characteristic of the T39 vest render such turning aside difficult and the method of assembly insures more rigid mutual support of the components while effecting no sacrifice in flexibility. As a matter of fact the T39 type in spite of the larger component size exhibits greater flexibility.

7. While it must be recognized that the overall area of protection of the M1 vest is greater than that of the T39 type, it is contended that the superior resistance and greater flexibility characteristic of the T39 vest strongly recommend consideration of this vest and of the principles it portrays in any plans for the improvement of body armor.

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TABLE I

Comparative Resistance to Perforation of
Flyers' Protective Armor, M1, and Experimental Armor Vest, T39

Sample	Ballistic Limits			
	Cal. .45 ¹	G-2 ²	G-1-S ³	G-1-A ⁴
M1-1	1010	PP*	1350	610
M1-2	994	PP*	1305	523
M1-3	991	PP*	1313	753
T39-1	1151	PP*	1458	745
T39-2	1054	PP*	1442	755
T39-3	1139	PP*	1419	670

¹Cal. .45 steel-jacketed ball projectile (230 grains)

²Cal. .22 fragment-simulating projectile (17 grains)

³Cal. .30 fragment-simulating projectile (34 grains)

⁴Cal. .30 fragment-simulating projectile (150 grains)

*Partial penetration resulted at highest velocity obtainable with current testing equipment.

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5 OCT 1944

EXPERIMENTAL ARMOR VEST, T39, AFTER FIRING

WTN.710-2329



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EXPERIMENTAL ARMOR VEST, T39, AFTER FIRING. CUT AWAY TO SHOW CONSTRUCTION
5 OCT 1944 WTN.710-2330

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